Reference & Program Instructions

Model 197 Autoranging Microvolt DMM

INTRODUCTION

This reference and programming guide contains condensed specifications and information which describes the various features of the Model 197. Each feature is described in three segments. The first segment describes the feature. The second segment gives an exact procedure on how to use the feature. The third segment gives an example of where this feature might be used. Refer to the Model 197 Instruction Manual for complete information and essential safety information.

With the Model 1973 IEEE-488 optional interface installed, the Model 197 can be controlled over the IEEE-488 bus. This guide also contains information that concerns Model 197 bus operation. Several example programs using some commonly used controllers are outlined to get the Model 197/1973 "up and running". More detailed information and programming examples may be found in the Model 1973 Instruction Manual.

CONTENTS

CONDENSED SPECIFICATIONS 2
MODEL 197 FEATURES 5-15
IEEE-488 PROGRAMMING 16
ANALOG OUTPUT (Model 1972 only) 21
TALK ONLY OPERATION 23
PROGRAMS 24
IBM-PC or XT Personal Computer (Keithley Model 8573 Interface) 25
APPLE II (APPLE Interface) 27
HP 85 28
HP 9825A 29
HP 9816 30
PET/CBM 2001 31
DEC LSI 11 32
OPTIONS AND ACCESSORIES 34

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CONDENSED SPECIFICATIONS

FUNCTION	RANGE	ACCURACY +(%RDG + Counts) 18° – 28°C
DCV (⎓)	200mV	0.016 + 3
	2V	0.011 + 2
	20V	0.015 + 2
	200V-1000V	0.015 + 2
ACV (~)	200mV-200V	0.35 + 100, 50Hz-10kHz 1.5 + 250, 20Hz-50kHz
	750V	1.8 + 250, 20kHz-50kHz
	All	3 + 400 to 100kHz
DCA	200μA-20mA	0.1 + 15
	200mA	0.2 + 15
	2000mA	0.2 + 15
	10A	0.75 + 15
ACA	200μA-2000mA	0.8 + 100, 50Hz-10kHz
	10A	1.0 + 100, 50Hz-1kHz
OHMS	200Ω-2k	0.02 + 3
	20k-200k	0.026 + 2
	2M	0.035 + 2
	20M	0.12 + 2
	200M	2.0 + 1
dBm	DC	Above -78dBm: ±(0.02 dBm + 1 count)
	AC (20Hz-20kHz)	Above -32dBm: ±0.18dBm -58 to -32dBm: ±2dBm (10kHz max)

5½ DIGIT DMM PERFORMANCE

AUTORANGE—In addition to easy manual range selection, the DCV, ACV and ohms functions can autorange. Microprocessor design changes ranges FAST so the autoranging is virtually "transparent" to the user.

300kHz TRMS BANDWIDTH—With specific accuracy to 100kHz and useable response to 300kHz, the Model 197 can be used in applications well beyond the audio range. True RMS response eliminates error due to non-sinusodial waveforms.

200MΩ RANGE—For measurements above 200kΩ, push the MΩ button. This allows the Model 197 to automatically select the 2MΩ, 20MΩ or 200MΩ range. Alternately, if the AUTO button is pressed, the Model 197 selects the range from 200Ω to 200MΩ.

1000MΩ INPUT IMPEDANCE—On DCV, the 200mV and 2V ranges have a very high input impedance for precise measurements. Errors due to loading are virtually eliminated with this high input impedance.

RECHARGEABLE BATTERY OPTION—Can be added to the Model 197 at the factory or in the field.

TRUE DIODE TEST—On the ohm function, push BOTH buttons marked with a diode symbol (⟶|⟵). The Model 197 then measures the forward voltage drop across a diode at a test current of 1.6mA.

220,000 COUNTS—The display exceeds the normal 5½ digit (199,999) displays.

2 or 4 WIRE OHMS—Accurately measure resistances in either configuration. 4 wire mode eliminates both contact and lead resistances. Automatically changes from one configuration to the other without links or switches.

TERMS

The symbol on the instrument denotes that the user should refer to the operating instructions in the Model 197 Instruction Manual.

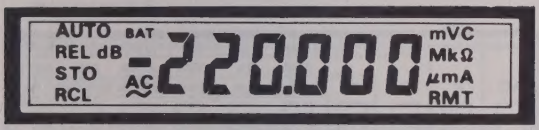
The symbol on the instrument denotes that high voltage may be present on the input terminals.

The safety precautions used in this guide explain hazards that could damage the instrument or cause personal injury or death.

SAFETY PRECAUTIONS

1. Before operation, ground the instrument through a properly grounded power receptacle.
2. Before servicing, disconnect the instrument from the power line and all other equipment. Consult the Maintenance section of the Model 197 Instruction Manual.
3. Do not touch the front panel input terminals while the instrument is turned on and/or connected to any other test equipment.

DISPLAY ANNUNCIATORS



AUTO—Indicates that the Model 197 is in the autorange mode.

REL—Indicates that the relative mode is selected. The reading is relative to some previously stored value.

dB—Indicates that the Model 197 is in the decibel mode. The reading is in units of dB, referenced to dBm at 600Ω.

STO—Indicates that the data logger and min/max function is running.

RCL—Indicates that the displayed reading is recalled data.

BAT—Indicates that the battery requires charging (operates only if the Model 1978 battery pack option is installed).

AC—Indicates that the Model 197 is in the AC measurement mode. AC volts or AC amps is selected. AC ohms is an invalid condition. DC is implied by the absence of the AC annunciator.

mV or V—Millivolts or volts. Read measurement directly from the display (e.g. 1.23456V)

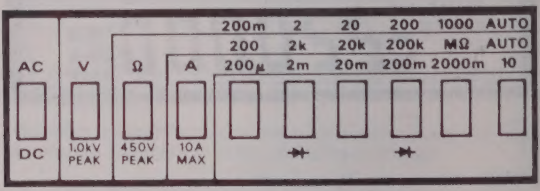
Ω, kΩ MΩ—Ohms, kilohms or megohms. Read measurement directly from the display (e.g. 12.3456kΩ)

μA, mA or A—Microamps, milliamps or amps. Read measurement directly from the display (e.g. 1.23456mA).

RMT (Remote)—Indicates that the Model 197 is in the remote mode of operation and therefore being controlled over the IEEE-488 bus (Model 1972 or 1973 interface installed).

C—Indicates that the Model 197 is in the calibration mode.

FUNCTIONS and RANGES



FUNCTIONS

DESCRIPTION

The Model 197 has six measurement functions (DCV, DCA, OHMS, ACV, ACA and dB). Each function is selected by pressing the appropriate function button. The AC/DC button is used along with the V (volts), A (amps) and dB functions. Depressing (in) this button selects AC and releasing (out) this button selects DC.

OPERATION

Press the appropriate button (buttons) to select the desired function.

TYPICAL USE

1. Press the V button to select the DC volts function.
2. With the V button selected, depress the AC/DC button to select the AC volts function. AC ohms is an invalid condition.

RANGES

DESCRIPTION

The range buttons select the desired range of measurement for the Model 197. The range may be selected manually or automatically. With manual range selection always use the range that allows the greatest amount of resolution. The amps function does not autorange. In general, where greater than 200V measurement is expected, use manual ranging. Auto range down ranges at approximately 20,000 counts.

OPERATION

Manual
1. Determine the signal to be measured.
2. Press the appropriate range button.
3. Apply signal.

Auto
1. Press the AUTO button.
2. Apply signal.

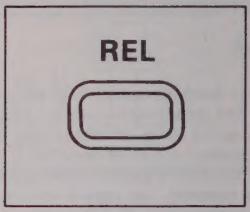
TYPICAL USE

Manual
Selecting appropriate range for anticipated signal level (e.g. 18V signal expected, then select the 20V range).

Diode test when the 2k and 200k ranges are selected simultaneously.

Auto
Leaving the range selection to the autoranging circuitry of the Model 197.

REL (Relative Function)



DESCRIPTION

The relative function serves as a means of baseline suppression allowing a stored offset value to be subtracted from subsequent readings. When the REL button is pressed, the instrument stores the baseline reading with the next conversion. All subsequent readings represent the differences between the applied signal level and the stored baseline. The stored baseline can be as small as the resolution of the instrument or as large as full range. The dynamic range of the instrument is $\pm$400,000 counts. This means if a rel level of -2.00000 is established, then applying +1.99999V to the input displays +3.99999V.

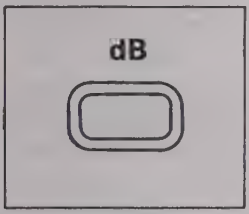
OPERATION

1. Select function and range. For example: DCV and the 20V range.
2. Press REL. The display reads zero.
3. The value that appeared on the display is now the stored offset.

TYPICAL USE

1. Nulling out external source offset (e.g. thermals on μV range, bias currents).
2. Comparing voltages. Apply the source and press the REL button. Subsequent readings show only the difference between the two. Such as when looking for losses, drifts or variations.
3. Nulling out lead resistance on low value resistance measurements.
4. Used with dB function, stage gains and attenuations can easily be made while reading the level of one stage, press REL. Subsequent readings show dB gain or loss relative to previous stage.

dB (Decibel Function)



DESCRIPTION

This button selects the dB function and is used with the ACV or DCV function. The displayed reading is directly in dB. The dB measurements make it possible to compress a large range of readings into a much smaller scope. Units of dB are defined below:

$$dB = 20 \log \left| \frac{V_{IN}}{V_{REF}} \right|$$

where $V_{REF} = \sqrt{(1mW)\ (600\Omega)}$
(dBm referenced to 600Ω)
Thus $V_{REF} = 0.774597V$

OPERATION

1. Select appropriate function (ACV or DCV).
2. Select autorange for optimum resolution.
3. Press the dB button.
4. Apply the signal.
5. Make the dB reading from the display.

TYPICAL USE

dBm—Press the dB button and the Model 197 reads directly in dBm (decibels above or below 1mW), with a standard reference impedance of 600Ω. The Model 197 covers a wide dynamic range from −58 to +59.8dBm on ACV and −117 to +62 on DCV.

Autoranging—Although manual ranging can be used, we suggest taking advantage of the Model 197's autoranging when making dB measurements. This allows you to cover the full 118dB dynamic range without touching the controls, and eliminates inaccuracies caused by selecting the wrong range.

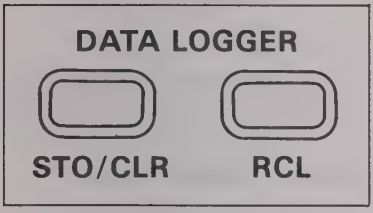
Other Impedances—The REL button allows direct reading dBm measurements with other reference impedances. Simply apply the appropriate voltage (see the manual for correct reference voltage for various impedances) to the input and press the REL button to store the new reference level.

REL dB—Use of the REL and dB functions together also allows dBW measurements and dB voltage measurements, independent of impedance. Direct measurement of stage gains and losses in dB are easy, too, with the dB and REL function. While measuring the dB level of one stage, press the REL button. Future readings are direct dB gains or losses relative to the previous stage.

RF Measurements—Using our accessory rf probe (Model 1682A) with the dB and REL function, direct dB gain/loss measurements up to 250MHz are easily made.

IEEE-488/System Applications—With the IEEE-488 interface (option 1972 or 1973) installed, the Model 197 becomes a system dB meter. The REL and dB functions, as well as the range (including autorange), are controllable on the IEEE-488 (GPIB) bus.

DATA LOGGER with MIN/MAX HOLD



DESCRIPTION

The data logger can store up to 102 readings including minimum and maximum readings recorded during the period the data logger is activated. The 102 points of data are stored at a user selectable rate (one of seven). The rates span from every reading (three per second) to one reading per hour.

Also, manual triggering is available (r = 6). In the r = 6 mode, one reading is stored every time the STO/CLR button is pressed. Readings for minimum and maximum are sampled at the rate of three readings per second regardless of the selected storage rate.

OPERATION

1. Connect the desired measurement configuration to the Model 197.
2. Select the desired rate of storage and start the data logger.
   A. Press and hold in the STO/CLR button.
   B. The rates are scrolled on the display. The rates are shown below.
   C. Release the STO/CLR button when the desired rate is displayed.
   D. In the manual trigger mode (r = 6), a reading is stored every time the STO/CLR button is pressed. The following sequence takes place after the STO/CLR button is pressed:
      a. The Model 197 stores the reading.
      b. The buffer location is briefly displayed. For example, buffer location #1 is displayed as n = 01.
      c. The Model 197 displays the applied signal and waits for the next manual trigger.

NOTE

There is no need to select a rate if just minimum/maximum readings are desired. Press the STO/CLR button to start the logger.

3. The STO annunciator turns on indicating that data is being stored at the selected rate.
4. The data logging sequence may be stopped by pressing the STO/CLR button, except in the r = 6 mode. In the r = 6 mode, press RCL and then STO/CLR to exit the manual trigger mode.

RCL (Recall Logged Data)

The stored data may be recalled at any time. A blinking RCL annunciator indicates that the maximum number of readings have been stored. Recall the data as follows:

1. Press and hold in the RCL button. The display scrolls through the data points and minimum/maximum (LO/HI). The first data point displayed is the last stored reading. The next two data points are the maximum and minimum readings made during the logging cycle. The maximum and minimum reading is depicted by the display n = HI. The minimum reading is depicted by the display n = LO. Then the buffer locations are scrolled on the display. Release the RCL button at the desired location to view the data that is stored. Notice that the longer the RCL button is held in the faster the data points scroll on the display.
2. Release the RCL button at the desired data point and note the reading (data) on the display. The data pointer may be incremented by steps of one by momentarily holding in the RCL button.
3. Shut off the data logger by pressing the STO/CLR button. All stored data is retained until a new cycle has commenced or the unit is turned off. Even after the data logger has been turned off, RCL may be used to recall the stored data.

RECALL LOGGED DATA OVER THE BUS

Readings that have been stored in the Data Logger may be retrieved and sent over the IEEE-488 bus. The data in the data logger is not discarded when it is retrieved. The data remains in the buffer until changed. The logger is controlled by the B command as follows:

B0 = Do not send logged readings and return the Model 197 to the normal operating mode.
B1 = Send logged readings.

The readings are sent in the following format:

001, NDCV ± 1.23456E-3
Data Pointer Data Format

*Where Data Pointer data means:

101 = Maximum reading stored (n = HI in the Data Store)
102 = Minimum reading stored (n = LO in the Data Store)
001 = First reading stored (n = 01)
...
...
...
100 = 100th reading stored (n = 100)
000 = Not a logged (stored) reading.

*This is the actual order in which the readings are sent.

Display/Storage Rate

r = 0: Every reading
r = 1: 1 reading per second
r = 2: 1 reading per 10 seconds
r = 3: 1 reading per minute
r = 4: 1 reading per 10 minutes
r = 5: 1 reading per hour
r = 6: 1 reading every time the STO/CLR button is pressed

TYPICAL USE

1. Overnight power supply drift.
2. Battery discharge curves.
3. Recording low frequency or 1/F noise.
4. Taking data for later analysis (r = 6).

MIN/MAX HOLD

The minimum/maximum feature detects and holds the highest and lowest readings whenever the data logger is used. This action is independent of the storage rate and runs at a rate of three readings per second. This function works in conjunction with the data logger. The minimum readings are continuously updated while in the data logger mode.

DIGITAL CALIBRATION

The digital calibration feature eliminates calibration potentiometers. All calibration factors for each range and function are stored in non-volatile RAM (NVRAM). With no troublesome potentiometers to adjust repeatable calibration to the least significant digit is fast and easy. The instrument can be calibrated from the front panel or with the Model 1973/1972 IEEE 488 interface. With the Model 1973 or 1972 installed, the Model 197 can be calibrated much faster using an automated calibration system. Front panel digital calibration is outlined as follows:

NOTE

The following is an actual calibration procedure for the 20VDC range. If recalibration is not necessary, then do not move the calibration jumper. Leave the calibration jumper in the disable position. Refer to the Model 197 Instruction Manual for calibration jumper placement.

1. Move the calibration jumper to the enable position. Factory setting is disable position.
2. Turn on the Model 197.
3. Press the REL and dB buttons simultaneously until the message "CAL" is displayed. Release the buttons. The Model 197 is now in the calibration mode as indicated by the "CAL" annunciator.
4. Apply the proper signal or level to the Model 197 input. Example: select the 20VDC range and apply + 19.0000V.

NOTE

Consult the Model 197 Instruction Manual for detailed instructions concerning the calibration levels.

5. Adjust the displayed reading accordingly with the use of the STO/CLR and RCL buttons. In the calibration mode, the STO/CLR button increments the displayed reading. The RCL button decrements the displayed reading.
6. If the data is not to be stored and the position of the CAL jumper is not known, turn off the unit. The old calibration constants are saved and reused on power up.

7. Press the dB and REL buttons simultaneously until the message "STOR" is displayed. The "new" calibration point for the 20VDC range is now permanently stored. This new constant remains as is until changed.
8. Turn the instrument off and place the calibration jumper in the disable position to prevent inadvertent calibration of the instrument.

Consult the Model 197 Instruction Manual for complete details concerning Model 197 calibration. The preceding procedure is presented here as a summary.

IEEE-488 Option—Allows the user to calibrate the instrument over the IEEE-488 bus. With the IEEE-488 interface installed (option 1973 or 1972), the Model 197 can be calibrated on most automated calibration systems.

IEEE-488 PROGRAMMING

The Keithley Model 197 has an optional IEEE-488 interface (Model 1973 and 1972) which can be included with the instrument or added later. The Model 1973 is an IEEE-488 interface that is designed to enhance the capabilities of the Model 197 by allowing the transmission of data and commands over the bus. The Model 1972 is very similar to the Model 1973 except that the Model 1972 includes an analog output (1973 does not). Because the two models are so similar, the Model 1973 is referred to throughout this section. The analog output description only pertains to the Model 1972.

Installation of the interface is apparent by the connector and address switch at the rear panel. The field installable option kit includes a replacement top cover with appropriate access openings on the rear panel. The following is a list of all the commands available to Model 197/1973.

dB:	D0 = dB off D1 = dB on		
Range:		Volts	Ohms	(Amps Not Programmable)
	R0 =	Auto	Auto	
	R1 =	200m	200	
	R2 =	2	2k	
	R3 =	20	20k	
	R4 =	200	200k	
	R5 =	1000	MΩ	
Relative:	Z0 = REL Off Z1 = REL On			
Logger:	B0 = Front Panel Readings B1 = Send Logged Readings			
Trigger:	T0 = Continuous on Talk T1 = One-shot on Talk T2 = Continuous on GET T3 = One-shot on GET T4 = Continuous on X T5 = One-shot on X			

EOI:	K0 = EOI Enabled K1 = EOI Disabled
Status Word:	U0 = Output status word.
SRQ Mode:	M0 = Clear SRQ data mask. M1 = Reading Overflow M8 = Reading Done M9 = Reading Done or Reading Overflow M16 = Busy M17 = Busy or Reading Overflow M24 = Busy or Reading Done M25 = Busy, Reading Done or Reading Overflow M32 = Clear SRQ error mask. M33 = IDDCO M34 = IDDC M35 = IDDC or IDDCO M36 = Not in Remote M37 = Not in Remote or IDDCO M38 = Not in Remote or IDDC M39 = Not in Remote, IDDC or IDDCO
Data Format:	G0 = Readings with Prefix G1 = Readings without Prefix
Digital Calibration:	V±n.nnnnnE±nn n = represents calibration value.
Store:	L0 = Store Calibration Constants.
Terminator:	Y(ASCII) = ASCII Character Y(CR LF) = CR LF Y(LF CR) = LF CR Y(DEL) = None
Execute:	X = Execute other device-dependent commands.

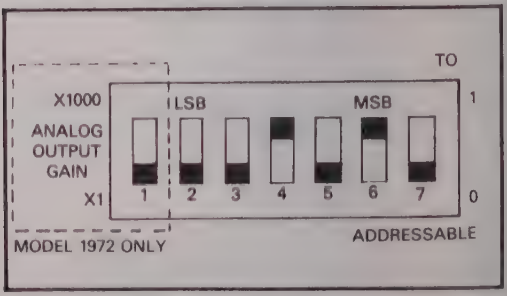
POWER UP DEFAULT CONDITIONS

MODE	VALUE/STATUS
Data Logger	Off
Range	Reflects Front Panel Buttons
dB	Off
Relative	Z0 (off)
Calibration	Off
Trigger	T0 (Continuous on Talk)
EOI	K0 (EOI is transmitted on last byte out.)
SRQ	M0 and M32 (SRQ off)
Alternate Output	Standard Output
Logger	B0 (Buffer) Do no send stored readings
Data Format	G0 (Prefix Enabled)
Terminator	(CR) (LF)

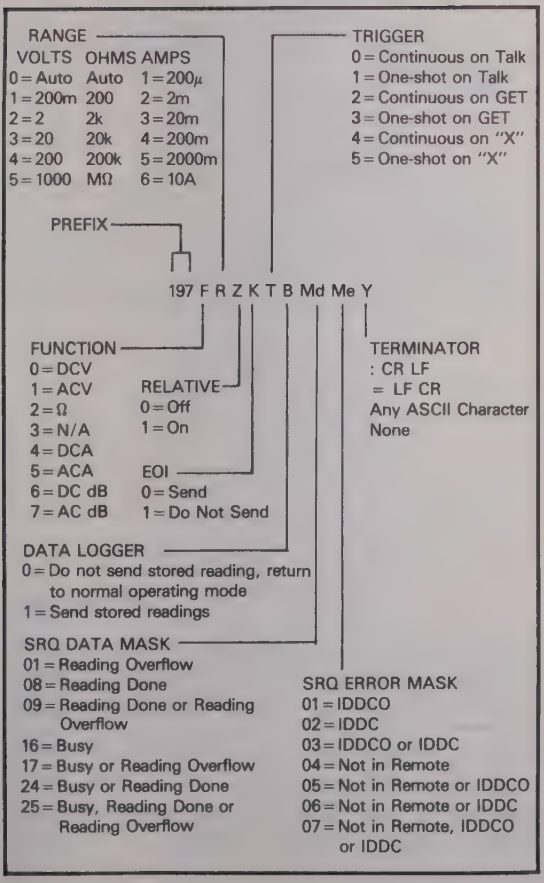
DEFAULT

```
1 9 7 F 0 R 1 Z 0 K 0 T 0 B 0 M 0 M 0 Y :
```

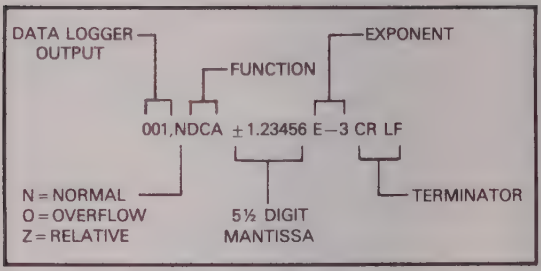
MODEL 1973 PRIMARY ADDRESS SWITCH SET TO 20



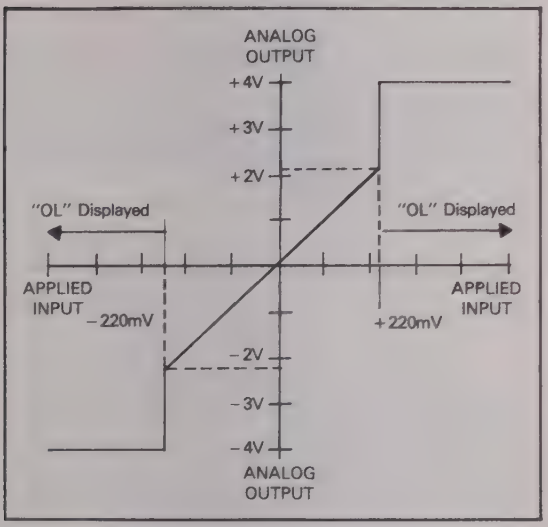
STATUS FORMAT


RANGE
VOLTS OHMS AMPS
0 = Auto Auto 1 = 200μ
1 = 200m 200 2 = 2m
2 = 2 2k 3 = 20m
3 = 20 20k 4 = 200m
4 = 200 200k 5 = 2000m
5 = 1000 MΩ 6 = 10A
TRIGGER
0 = Continuous on Talk
1 = One-shot on Talk
2 = Continuous on GET
3 = One-shot on GET
4 = Continuous on "X"
5 = One-shot on "X"
PREFIX
197 F R Z K T B Md Me Y
FUNCTION
0 = DCV
1 = ACV
2 = Ω
3 = N/A
4 = DCA
5 = ACA
6 = DC dB
7 = AC dB
RELATIVE
0 = Off
1 = On
EOI
0 = Send
1 = Do Not Send
TERMINATOR
: CR LF
= LF CR
Any ASCII Character
None
DATA LOGGER
0 = Do not send stored reading, return to normal operating mode
1 = Send stored readings
SRQ DATA MASK
01 = Reading Overflow
08 = Reading Done
09 = Reading Done or Reading Overflow
16 = Busy
17 = Busy or Reading Overflow
24 = Busy or Reading Done
25 = Busy, Reading Done or Reading Overflow
SRQ ERROR MASK
01 = IDDCO
02 = IDDC
03 = IDDCO or IDDC
04 = Not in Remote
05 = Not in Remote or IDDCO
06 = Not in Remote or IDDC
07 = Not in Remote, IDDCO or IDDC

DATA FORMAT


DATA LOGGER OUTPUT
EXPONENT
FUNCTION
001,NDCA ±1.23456 E−3 CR LF
N = NORMAL
O = OVERFLOW
Z = RELATIVE
5½ DIGIT MANTISSA
TERMINATOR

ANALOG OUTPUT (1972 only)



DESCRIPTION

The analog output, an exclusive feature of the Model 1972, is useful for monitoring the input signal with an external device such as a chart recorder. With the two levels of gain (X1 and X1000), full 5½ digit resolution can be realized. On the X1, gain 1V output corresponds to 100,000 counts. On the X1000 gain, 1V output corresponds to 100 counts. The accuracy of the analog output is ±(0.25% of displayed reading +2mV.

The output resistance of the analog output is 1kΩ. This is true for all ranges regardless of the gain status. Thus, loading problems caused by external devices are kept to a minimum.

OPERATION

1. Select the desired gain. The gain switch is on the same bank of switches as the primary address switches. Power does not have to be cycled.
2. Connect the external device (e.g. chart recorder) to the analog output terminals. The terminals are located on the rear panel of the Model 197 1972. Be sure to note the polarity of the connections.
3. See external device for desired parameters.
4. Apply signal to the Model 197.

TYPICAL USE

Monitoring signal levels with a chart recorder.

TALK ONLY OPERATION

The talk only mode may be used to send data to a listen only device such as a printer. When the Model 197 is in the talk mode, it ignores commands given over the IEEE-488 bus. The talk only mode is enabled by placing the TO/ADDRESSABLE switch in the TO position (refer to rear panel) and cycling power to the instrument. The default talk rate is three readings per second (every reading). However, a different talk rate can be selected by performing the following procedure:

1. Press and hold in the STO/CLR button. The following talk rates scroll on the display:
   Display/Rate
   r=0: Every reading
   r=1: One reading per second
   r=2: One reading per 10 seconds
   r=3: One reading per minute
   r=4: One reading per 10 minutes
   r=5: One reading per hour
   r=6: One reading every time the STO/CLR button is pressed
2. Release the STO/CLR button when the desired talk rate is displayed. The STO annunciator turns on and the instrument talks at the selected rate.
3. Turn off the data store by again pressing the STO/CLR button. The STO annunciator turns off. In the r=6 mode, press RCL and then press the STO/CLR button.

NOTE

The instrument continues to talk at the selected rate until either a new rate is selected or power is cycled to the instrument.

When the Model 197 is used in the talk mode, it may be interfaced with one or more listeners. Each of these devices and associated cabling should conform to IEEE-488-1978 standards.

PROGRAMS

The following programs are designed to be a simple aid to the user. They are not intended to suit specific needs. Refer to the Model 1973 Instruction Manual for detailed programming information.

These programs display one reading at the output of the controller. The program provides an ASCII string variable output of the form:

NDCV +0.00000+0 CR LF

The note at the end of each program indicates modifications to provide a numeric variable (A) in exponential form:

+0.00000+0

IBM PC or XT (Keithley 8573 GPIB Interface)

The following program sends a command string to the Model 197 from an IBM PC or XT computer and displays the instrument reading on the display. The computer must be equipped with a Keithley Model 8573 GPIB IEEE interface and the DOS 2.0 operating system. The GPIB software and hardware must be configured per the Model 8573 Instruction Manual.

DIRECTIONS

1. Using the rear panel address switches set the primary address of the Model 197 (1973 to 20 (10100).
2. With the power off, connect the Model 197/1973 to the Model 8573 IEEE interface. The instrument is installed in the IBM computer per the hardware configuration instructions in the Model 8573 Instruction Manual.
3. Turn on the equipment.
4. Place the interface software disk in the default drive, type LOAD "DECL" and press the return key.
5. Press the LIST key and then the RETURN key to display the first 6 lines of the program. Lines 1-6 are part of the DECL program previously loaded and need not be typed in. However, an address value needs to be added in place of the X's on lines 1 and 2. To complete the address value, refer to the General Programming Procedure in the Model 8573 Instruction Manual.
6. Enter the following program lines to the computer, pressing the RETURN key after each line is typed.
7. Run the program and type in the desired command when prompted. For example, To place the Model 197 in the one-shot on talk trigger mode and in the 20V range, type in T1R3X and press the return key.
8. The CRT displays the Model 197 reading string. When the input of the Model 197 is shorted, the CRT display reads:

   NDCV +0.00000 E+1.

9. To exit the program type EXIT and press the return key.

NOTE

Lines 1-6 of this program need not be typed in and are not shown (see step 5). They are contained on the floppy disk. When the command LOAD "DECL" is entered, these lines are loaded into the computer.

PROGRAM	COMMENTS
10 CLS	
20 NA$ = "GP\B0" CALL IBFIND (NA$,BRD0%)	Find the board number.
30 NA$ = "DEV9" CALL IBFIND (NA$,M197%)	Find the 197 number.
40 V% = 20 CALL IBPAD (M197%,V%)	Change to primary address 20.
50 V% = 1 CALL IBSRE (BRD0%,V%)	Set REN true.
60 INPUT "COMMAND" CMD$	Prompt for command string.
70 IF CMD$ = "EXIT" THEN 150	See if program is to be halted.
80 IF CMD$ = "" THEN 60	If null command string, go back and get another.
90 CALL IBWRT (M197%,CMD$)	Address 197 to listen and send command string.
100 RD$ = SPACE$(50)	Assign reading input buffer.
110 CALL IBRD(M197%,RD$)	Address 197 to talk and input reading string.
120 RD$ = LEFT$(RD$,IBCNT%)	Trim string to proper size.
130 PRINT RD$	Display the reading on the CRT.
140 GOTO 60	Repeat
150 V% = 0 CALL IBONL (BRD0%, V%)	Close the board file.
160 CALL IBONL(M197%,V%)	Close the instrument file.
170 END	

NOTE: If conversion to numeric variable is desired, change lines 120 and 130 as follows:

```
120 RD = VAL(MID$(RD$,5,14))
130 PRINT RD
```

APPLE II (APPLE Interface)

The following program obtains one reading from the Model 197 and displays the reading on the APPLE II screen, using an APPLE IEEE-488 interface.

DIRECTIONS

1. Using the rear panel address switches on the Model 197 1973, set the primary address to 20 (10100).
2. Connect the Model 197 1973 to the APPLE II and APPLE IEEE-488 interface.
3. Turn on the equipment.
4. Boot up the Apple II with the DOS disk.
5. Enter the following program using the RETURN key after each line.
6. Type RUN and press the RETURN key. The display will read "TEST SETUP".
7. To program the Model 197 to the 20V range and take a reading, type in T1R3X. Then press the RETURN key.
8. With the Model 197 input shorted, the CRT displays:
   NDCV +0.00000E+1.

PROGRAM	COMMENTS
10 DIM A$(20),B$(20)	Dimension data string.
20 Z$ = CHR$(26)	Terminator
30 INPUT "TEST SETUP?"; B$	Enter programming command. Example: 20V range = R3T1X
40 PR#3	Send output to IEEE bus.
50 IN#3	Get input from IEEE bus.
60 PRINT "RA"	Turn remote on.
70 PRINT "LF1"	Linefeed on.
80 PRINT "WT4";Z$;B$	Write B$ to Model 197.
90 PRINT "RDT";Z$;:INPUT " ";A$	Read data from 197.
100 PRINT "UT"	
110 PR#0	Send output to CRT.
120 IN#0	Get input from keyboard.
130 PRINT A$	
140 GO TO 30	Repeat

NOTE: If conversion to numeric variable is desired, add the following:

```
125 A = VAL(MID$(A$,5,11))
130 PRINT A
```

HP 85

The following program obtains one reading from the Model 197 and displays the reading on the HP 85 CRT, using the 82937A GPIB interface and an I/O ROM.

DIRECTIONS

1. Using the rear panel address switches set the primary address on the Model 197/1973 to 20 (10100).
2. With the power off connect the Model 197/1973 to the HP 82937A IEEE interface.
3. Turn on the equipment.
4. Enter the following program into the HP 85 keyboard. Press the END LINE key after each line is typed.
5. Press the RUN key to start the program.
6. The CRT displays "TEST SETUP?".
7. To program the Model 197 to the 20V range and take a reading, type in T1R3X. Then press the END LINE key.
8. With the Model 197 input shorted, the CRT displays:
   NDCV +0.00000E+1.

PROGRAM	COMMENTS
10 REMOTE 720	Set to remote.
20 DISP "TEST SETUP"	Prompt for test set up.
30 INPUT B$	
40 OUTPUT 720;B$	Prompt the Model 197.
50 ENTER 720;A$	Get data from 197.
60 DISPA$	
70 GO TO 20	Repeat
80 END	

NOTE: If conversion to numeric variable is desired, change line 60 as follows:

```
60 DISP VAL(A$[5])
```

HP 9825A

The following program obtains one reading from the Model 197 and displays the reading on the HP 9825A HPIB interface and a 9872A extended I/O ROM.

DIRECTIONS

1. Using the rear panel address switches set the primary address of the Model 197 to 20 (10100).
2. With the power off, connect the Model 197/1973 to the HP 9825A and 98034A HPIB interface.
3. Turn the equipment on.
4. Enter the following program using the STORE key after each line is typed. Line numbers are automatically assigned by the 9825A.
5. Press the RUN key to run the program.
6. The display will read "TEST SETUP".
7. To program the Model 197 to the 20V range and take a reading type in T1R3X and press the CONT key.
8. With the Model 197 input shorted, the printer displays:
   NDCV +0.00000E+1.

PROGRAM	COMMENTS
0 dim A$[20],B$[20]	Dimension data string.
1 dev "197",720	Define Model 197 address 20 (10100).
2 rem "197"	Set to remote.
3 ent "TEST SETUP", B$	Enter programming command. Example: 20V range = T1R3X
4 wrt "197",B$	Output program command to Model 197 via IEEE bus.
5 red "197",A$	Read data from Model 197 via IEEE bus.
6 prt A$	Print data on hard copy printer.
7 gto 3	Repeat

NOTE: If conversion to numeric variable is desired, omit lines 6 and 7 and substitute the following:

6 "e" → A$[13,13];flt5	Convert to numeric variable.
7 prt val(A$[5])	
8 gto 3	Repeat

HP 9816

The following program sends a command string to the Model 197, reads data and displays the data on the HP 9816 CRT, using BASIC 2.0.

DIRECTIONS

1. Using the rear panel address switches set the primary address of the Model 197/1973 to 20 (10100).
2. With the power off, connect the Model 197/1973 to the HP 9816 and HP 82937A GPIB interface.
3. Boot up the HP 9816 with the BASIC 2.0 program.
4. Turn the Model 197/1973 on.
5. Type EDIT and press the EXEC key.
6. Enter the following program using the ENTER key after each line is typed.
7. To start the program press the RUN key on the HP 9816.
8. The CRT displays "TEST SETUP".
9. To program the Model 197 to the 20V range and take a reading, type in T1R3X and press the ENTER key
10. With the Model 197 input shorted, the CRT displays:
    NDCV +0.00000E+1.

PROGRAM	COMMENTS
10 REMOTE 720	Set to remote.
20 INPUT "TEST SETUP",A$	Prompt for test setup.
30 OUTPUT 720;A$	Program the 197.
40 ENTER 720;B$	Read the data from the 197.
50 PRINT B$	
60 GO TO 20	Repeat
70 END	

NOTE: If conversion to numeric variable is desired, change lines 40 and 50 as follows:

```
40 ENTER 720;A
50 PRINT A
```

PET/CBM 2001

The following procedure obtains one reading from the Model 197 and displays the reading on the PET CBM 2001 screen.

DIRECTIONS

1. Using the rear panel address switches, set the primary address of the Model 197/1973 to 20 (10100).
2. With the power off, connect the Model 197 to the PET CBM 2001 IEEE interface.
3. Turn on the equipment.
4. Enter the following program using the RETURN key after each line is typed.
5. To start the program type RUN and press the RETURN key.
6. The CRT displays "TEST SETUP".
7. To program the Model 197 to the 20V range and take a reading, type in T1R3X and press the RETURN key.
8. With the Model 197 input shorted, the CRT displays:

NDCV +0.00000E+1.

PROGRAM	COMMENTS
10 OPEN 6,20	Open file 6, primary address 20.
20 INPUT "TEST SETUP";B$	Enter programming command. Example: 20V range = T1R3X.
30 PRINT#6,B$	Output to IEEE bus.
40 INPUT#6,A$	Read data from Model 197 via IEEE bus.
50 PRINT A$	Display data.
60 GO TO 20	Repeat

NOTE: If conversion to numeric variable is desired, omit line 60 and type the following:

```
70 A = VAL(MID$(A$,5,15))
80 PRINT "A=" ;A
90 GO TO 20
```

DEC LSI 11

The following program obtains one reading from the Model 197 and displays the reading on the DEC LSI microcomputer CRT terminal. The LSI 11 must be configured with 16K words of RAM and an IBV 11 IEEE interface. The software must be configured with IB software as well as the FORTRAN and the RT 11 operating system.

DIRECTIONS

1. Using the rear panel address switches, set the primary address of the Model 197/1973 to 20 (10100).
2. With the power off, connect the Model 197 to the IBV 11 IEEE cable.
3. Turn on the equipment.
4. Enter the following program, using the editor under RT 11 and the name IDALEC.
5. Compile using the fortran compiler as follows: FORTRAN IDALEC.
6. Link with the system the IB libraries as follows: LINK IDALEC,IBLIB.
7. Type RUN IDALEC and depress the RETURN key.
8. The CRT displays "ENTER ADDRESS".
9. Type in 20 and press the RETURN key.
10. The CRT displays "TEST SETUP".
11. To program the Model 197 to the 20V range and take a reading, type in T1R3X and press the RETURN key.
12. With the Model 197 input shorted, the CRT displays:

NDCV +0.00000E+1.

PROGRAM	COMMENTS
INTEGER*2 PRIADR	
LOGICAL*1MSG(80), INPUT(80)	
DO 2 I = 1,10	
CALL IBSTER(I,0)	Turn off IB errors.
2 CONTINUE	
CALL IBSTER (15,5)	Allow 5 error 15's.
CALL IBTIMO (360)	Allow 1 second bus timeout.
CALL IBTERM ("10)	Set LF as terminator.
CALL IBREN	Turn remote on.
4 TYPE 5	
5 Format (1X,'ENTER	Input the address 20.
ADDRESS: ',$) ACCEPT 10,	
PRIADR	
10 FORMAT (2I4)	
12 TYPE 15	
15 FORMAT (1X,'TEST SETUP? ',$)	Prompt for the test setup.
CALL GETSTR (5,MSG,72)	Get the test setup.
CALL IBSEOI (MSG,-1 PRIADR)	Program the 197.
18 I=IBRECV (INPUT,80,PRIADR)	
INPUT (I + 1) = 0	
CALL PUTSTR (7,INPUT,'0')	
CALL IBUNT	Untalk the 197.
GO TO 12	Repeat
END	

Options and Accessories

The Keithley Model 197 has a number of options and accessories that extend it's usefulness and applicability.

OPTIONS:

There are two optional capabilities that can be added internally to the Model 197: an IEEE-488 interface option and a rechargeable battery pack. Either or both of these options can be included in the instrument when purchased and either or both can be field installable later. The options and configurations are as follows:

197	5½-digit Autoranging Microvolt DMM
1972	IEEE-488 interface option with analog output for Model 197 —field installable
1973	IEEE-488 interface option for Model 197 —field installable
1978	Rechargeable battery pack option for Model 197 —field installable

ACCESSORIES:

1010	Single Rack Mounting Kit
1017	Dual Rack Mounting Kit
1301	Temperature Probe (−55 to +150°C)
1600A	High Voltage Probe (140kV)
1641	Kelvin Test Lead Set
1651	50-Ampere Current Shunt
1681	Clip-On Test Lead Set
1682A	RF Probe (250MHz)
1684	Hard Shell Carrying Case
1685	Clamp-On Current Probe (200A)
1751	Safety Test Leads
1754	Safety Universal Test Lead Kit
1972	IEEE-488 with Analog Output
7008-3	IEEE-488 Digital Cable, 0.9m (3 ft.)
7008-6	IEEE-488 Digital Cable, 1.8m (6 ft.)
8573	IEEE-488 Interface for IBM PC

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